

CLAIMS

I claim:

1. A method and system for improving diagnostic imaging and/or delivering therapeutically active agents used in control of hyperlipidemia, comprising:
 - (a) assembling a nanoscale container having a partition of hydrophobic active ingredient of a drug in the core of a micelle;
 - (b) simultaneously with (a) and a hydrophilic corona surrounding the core yielding spherical micelles;
 - (c) incorporating LDL receptors into the corona;
 - (d) incorporating tissue specific peptides that induce fusion or lysis of membrane;
 - (e) introducing the said micelles into the blood stream of a patient with circulating LDL molecules in the blood stream;
 - (f) forming micelle aggregates with circulating LDL molecule
 - (g) determining the presence of the micelle aggregates by interaction with ultrasound irradiation or magnetic resonance to generate a detectable signal
 - (h) entering the targeted cells by endocytosis and delivering the therapeutically active agent and LDL molecules into the cytoplasm;
 - (i) simultaneously with (h) lowering the concentration circulating LDL molecules;
 - (j) simultaneously with (i) lowering the LDL-cholesterol synthesis only in specific tissues.
2. The invention of claim 1, wherein the therapeutically active agent is a drug included in the core of the micelle, that is formulated for immediate release, pulsatile release, controlled release, extended release, delayed release, targeted release, or targeted delayed release
3. The invention of claim 1, wherein the therapeutically active agent is delivered to the general circulation to prevent excessive extraction by the liver and improving the bioavailability.
4. The invention of claim 1, wherein the copolymer micelle aggregates are echogenic due to high lipid content on ultrasound images and generate hyperintense signals on magnetic resonance images.
5. The invention of claim 1, wherein the drug incorporated in the core of the micelle comprise a statin.
6. The invention of claim 1, wherein the tissue specific fusion or lysis protein ensures tissue differential elimination of cholesterol.

7. The invention of claim 1, wherein there is quantitative and qualitative determination of LDL molecules within the blood stream using imaging methods.
8. The invention of claim 1, wherein LDL is removed from plasma by the LDL receptor pathway and delivered to target tissues only.
9. A method and system for improving diagnostic imaging and/or delivering therapeutically active agents used in control of infectious diseases, comprising:
- (a) assembling a nanoscale container having a partition of hydrophobic active ingredient of a drug in the core of a micelle;
 - (b) simultaneously with (a) and a hydrophilic corona surrounding the core yielding spherical micelles;
 - (c) incorporating into the corona receptors for lipopolysacchride bacterial coat or glycoprotein for viral envelope;
 - (d) incorporating tissue specific peptides that induce fusion or lysis of membranes;
 - (e) introducing the said micelles into the blood stream of a patient infected with a pathologic microorganism;
 - (f) forming micelle aggregates with circulating microorganism
 - (g) determining the presence of the micelle aggregates by interaction with ultrasound irradiation or magnetic resonance to generate a detectable signal
 - (h) entering the targeted tissue cells that are lesion sites by endocytosis or transduction and delivering the therapeutically active agents into the cytoplasm;
 - (i) simultaneously with (h) eliminating the circulating microorganisms from the bloodstream
 - (j) simultaneously with (i) concentrating the therapeutically active agents only at lesion sites in specific tissues.
10. The invention of claim 9, wherein the suitable hydrophobic active ingredients are selected from a group consisting of analgesics, anti-inflammatory agents, antihelminthics, anti-arrhythmic agents, anti-bacterial agents, anti-viral agents, anti-coagulants, anti-depressants, anti-diabetics, anti-epileptics, anti-fungal agents, anti-gout agents, anti-hypertensive agents, anti-malarials, anti-migraine agents, anti-muscarinic agents, anti-neoplastic agents, erectile dysfunction improvement agents, immunosuppressants, anti-protozoal agents, anti-thyroid agents, anxiolytic agents, sedatives, hypnotics, neuroleptics, beta-Blockers, cardiac inotropic agents, corticosteroids, diuretics, anti-parkinsonian agents, gastro-intestinal agents, histamine receptor antagonists, keratolytics, lipid regulating agents, anti-anginal agents, cox-2 inhibitors,

leukotriene inhibitors, macrolides, muscle relaxants, nutritional agents, opioid analgesics, protease inhibitors, sex hormones, stimulants, muscle relaxants, anti-osteoporosis agents, anti-obesity agents, cognition enhancers, anti-urinary incontinence agents, nutritional oils, anti-benign prostate hypertrophy agents, essential fatty acids, non-essential fatty acids, and mixtures thereof.

11. The invention of claim 9, wherein specific, non-limiting examples of suitable hydrophobic active ingredients may be selected from: acetretin, albendazole, albuterol, aminoglutethimide, amiodarone, amlodipine, amphetamine, amphotericin B, atorvastatin, atovaquone, azithromycin, baclofen, beclomethasone, benazepril, benzonatate, betamethasone, bicalutamide, budesonide, bupropion, busulfan, butenafine, calcifediol, calcipotriene, calcitriol, camptothecin, candesartan, capsaicin, carbamazepine, carotenes, celecoxib, cerivastatin, cetirizine, chlorpheniramine, cholecalciferol, cilostazol, cimetidine, cinnarizine, ciprofloxacin, cisapride, clarithromycin, clemastine, clomiphene, clomipramine, clopidogrel, codeine, coenzyme Q10, cyclobenzaprine, cyclosporin, danazol, dantrolene, dexchlorpheniramine, diclofenac, dicoumarol, digoxin, dehydroepiandrosterone, dihydroergotamine, dihydrotachysterol, dirithromycin, donepezil, efavirenz, eprosartan, ergocalciferol, ergotamine, essential fatty acid sources, etodolac, etoposide, famotidine, fenofibrate, fentanyl, fexofenadine, finasteride, fluconazole, flurbiprofen, fluvastatin, fosphenytoin, frovatriptan, furazolidone, gabapentin, gemfibrozil, glibenclamide, glipizide, glyburide, glimepiride, griseofulvin, halofantrine, ibuprofen, irbesartan, irinotecan, isosorbide dinitrate, isotretinoin, itraconazole, ivermectin, ketoconazole, ketorolac, lamotrigine, lansoprazole, leflunomide, lisinopril, loperamide, loratadine, lovastatin, L-thyroxine, lutein, lycopene, medroxyprogesterone, mifepristone, mefloquine, megestrol acetate, methadone, methoxsalen, metronidazole, miconazole, midazolam, miglitol, minoxidil, mitoxantrone, montelukast, nabumetone, nalbuphine, naratriptan, nelfinavir, nifedipine, nilvadipine, nilutamide, nitrofurantoin, nizatidine, omeprazole, oprelvekin, oestradiol, oxaprozin, paclitaxel, paracalcitol, paroxetine, pentazocine, pioglitazone, pizofetin, pravastatin, prednisolone, probucol, progesterone, pseudoephedrine, pyridostigmine, rabeprazole, raloxifene, rofecoxib, repaglinide, rifabutin, rifapentine, rimexolone, ritanovir, rizatriptan, rosiglitazone, saquinavir, sertraline, sibutramine, sildenafil citrate, simvastatin, sirolimus, spironolactone, sumatriptan, tacrine, tacrolimus, tamoxifen, tamsulosin, targretin, tazarotene, telmisartan, teniposide, terbinafine, terazosin, tetrahydrocannabinol, tiagabine, ticlopidine, tirofiban, tizanidine,

topiramate, topotecan, toremifene, tramadol, tretinoin, troglitazone, trovafloxacin, ubidecarenone, valsartan, venlafaxine, verteporfin, vigabatrin, vitamin A, vitamin D, vitamin E, vitamin K, zafirlukast, zileuton, zolmitriptan, zolpidem, zopiclone, salts, isomers and derivatives of the above-listed hydrophobic active ingredients may also be used, as well as mixtures.

12. The invention of claim 9, wherein the hydrophilic active ingredient can be a cytokine, a peptidomimetic, a peptide, a protein, a toxoid, a serum, an antibody, a vaccine, a nucleoside, a nucleotide, a portion of genetic material, a nucleic acid, or a mixture thereof

13. The invention of claim 9, wherein, non-limiting examples of suitable hydrophilic active ingredients that could potentially be enclosed in the corona of the micelle are selected from: acarbose, acyclovir, acetyl cysteine, acetylcholine chloride, alatrofloxacin, alendronate, aglucerase, amantadine hydrochloride, ambenonium; amifostine, amiloride hydrochloride, aminocaproic acid, amphotericin B, antihemophilic factor (human), antihemophilic factor (porcine), antihemophilic factor (recombinant), aprotinin, asparaginase, atenolol, atracurium besylate, atropine, azithromycin, aztreonam, BCG vaccine, bacitracin, becalerin, belladonna, bepridil hydrochloride, bleomycin sulfate, calcitonin human, calcitonin salmon, carboplatin, capecitabine, capreomycin sulfate, cefamandole nafate, cefazolin sodium, cefepime hydrochloride, cefixime, cefonicid sodium, cefoperazone, cefotetan disodium, cefotaxime, cefoxitin sodium, ceftizoxime, ceftriaxone, cefuroxime axetil, cephalexin, cephalixin sodium, cholera vaccine, chorionic gonadotropin, cidofovir, cisplatin, cladribine, clidinium bromide, clindamycin and clindamycin derivatives, ciprofloxacin, clodronate, colistimethate sodium, colistin sulfate, corticotropin, cosyntropin, cromolyn sodium, cytarabine, dalteparin sodium, danaparoid, desferrioxamine, denileukin diflitox, desmopressin, diatrizoate meglumine and diatrizoate sodium, dicyclomine, didanosine, dirithromycin, dopamine hydrochloride, dornase alpha, doxacurium chloride, doxorubicin, etidronate disodium, enalaprilat, enkephalin, enoxaparin, enoxaprin sodium, ephedrine, epinephrine, epoetin alpha, erythromycin, esmolol hydrochloride, factor IX, famciclovir, fludarabine, fluoxetine, foscarnet sodium, ganciclovir, granulocyte colony stimulating factor, granulocyte-macrophage stimulating factor, growth hormones -recombinant human, growth hormone - bovine, gentamycin, glucagon, glycopyrolate, gonadotropin releasing hormone GnRH and synthetic analogs thereof, gonadorelin, grepafloxacin, hemophilus B conjugate vaccine, Hepatitis A virus vaccine inactivated, Hepatitis B virus vaccine inactivated, heparin sodium, indinavir sulfate, influenza

virus vaccine, interleukin-2, interleukin-3, insulin-human, insulin lispro, insulin procine, insulin NPH, insulin aspart, insulin glargine, insulin detemir, interferon alpha, interferon beta, ipratropium bromide, ifosfamide, Japanese encephalitis virus vaccine, lamivudine, leucovorin calcium, leuprolide acetate, levofloxacin, lincomycin and lincomycin derivatives, lobucavir lomefloxacin, loracarbef, mannitol, measles virus vaccine, meningococcal vaccine, menotropins, mepenzolate bromide, mesalamine, methenamine, methotrexate, methscopolamine, metformin hydrochloride, metoprolol, mezocillin sodium, mivacurium chloride, mumps viral vaccine, nedocromil sodium, neostigmine bromide, neostigmine methy sulfate, neurontin, norfloxacin, octreotide acetate, ofloxacin, olpadronate, oxytocin, pamidronate disodium, pancuronium bromide, paroxetine, perfloxacin, pentamidine isethionate, pentostatin, pentoxifylline, periciclovir, pentagastrin, pentholamine mesylate, phenylalanine, physostigmine salicylate, plague vaccine, piperacillin sodium, platelet derived growth factor-human, pneumococcal vaccine polyvalent, poliovirus vaccine inactivated, poliovirus vaccine live (OPV), polymyxin B sulfate, pralidoxime chloride, pramlintide, pregabalin, propafenone, propenthaline bromide, pyridostigmine bromide, rabies vaccine, residronate, ribavarin, rimantadine hydrochloride, rotavirus vaccine, salmeterol xinafoate, sinealide, small pox vaccine, sotalol, somatostatin, sparfloxacin, spectinomycin, stavudine, streptokinase, streptozocin, suxamethonium chloride, tacrine hydrochloride, terbutaline sulfate, thiopeta, ticarcillin, tiludronate, timolol, tissue type plasminogen activator, TNFR:Fc, TNK-tPA, trandolapril, trimetrexate gluconate, trospectinomycin, trovafloxacin, tubocurarine chloride, tumor necrosis factor, typhoid vaccine live, urea, urokinase, vancomycin, valacyclovir, valsartan, varicella virus vaccine live, vasopressin and vasopressin derivatives, vecuronium bromide, vinblastine, vincristine, vinorelbine, vitamin B12, warfarin sodium, yellow fever vaccine, zalcitabine, zanamivir, zolendronate, zidovudine, pharmaceutically acceptable salts, isomers and derivatives thereof, and mixtures thereof.

14. A method and system for improving diagnostic imaging and/or delivering therapeutically active agents used in control of infectious diseases, comprising:

- (a) assembling nanoscale diblock copolymer vesicles having a hydrophobic and a hydrophilic segment;
- (b) inserting a natural channel protein in its membrane for docking of viruses or bacteria
- (c) inserting tissue specific membrane proteins for lysis or fusion;
- (d) introducing the said copolymer vesicles into the blood stream of a patient with circulating

pathologic microorganisms;

(e) forming vesicle aggregates with circulating pathologic microorganism

(f) determining the presence of the vesicle aggregates with microorganisms in the vessels using an imaging method;

(g) entering the targeted cells by endocytosis or transduction and delivering the therapeutically active agents into the cytoplasm of targeted tissue sites;

(h) simultaneously with (g) eliminating the microorganism in the bloodstream

(i) simultaneously with (h) raising the concentration of the therapeutically active agents only in specific tissues at lesion sites to prevent drug resistance and toxicity.

15. The invention of claim 14, wherein block copolymer vesicles carrying an aqueous drug and delivering high concentrations of the drug to the bloodstream for longer circulation time and improving the bioavailability of the drug.

16. The invention of claim 14, wherein the therapeutically active agents are deoxyribonucleic acid using virus assisted loading into copolymer vesicles and subsequently using tissue specific fusion or lysis protein to reach cells of target tissues.

17. The invention of claim 14, wherein, non-limiting examples of suitable hydrophobic active ingredients are selected from: acetretin, albendazole, albuterol, aminoglutethimide, amiodarone, amlodipine, amphetamine, amphotericin B, atorvastatin, atovaquone, azithromycin, baclofen, beclomethasone, benazepril, benzonatate, betamethasone, bicalutamide, budesonide, bupropion, busulfan, butenafine, calcifediol, calcipotriene, calcitriol, camptothecin, candesartan, capsaicin, carbamazepine, carotenes, celecoxib, cerivastatin, cetirizine, chlorpheniramine, cholecalciferol, cilostazol, cimetidine, cinnarizine, ciprofloxacin, cisapride, clarithromycin, clemastine, clomiphene, clomipramine, clopidogrel, codeine, coenzyme Q10, cyclobenzaprine, cyclosporin, danazol, dantrolene, dexchlorpheniramine, diclofenac, dicoumarol, digoxin, dehydroepiandrosterone, dihydroergotamine, dihydrotachysterol, dirithromycin, donepezil, efavirenz, eprosartan, ergocalciferol, ergotamine, essential fatty acid sources, etodolac, etoposide, famotidine, fenofibrate, fentanyl, fexofenadine, finasteride, fluconazole, flurbiprofen, fluvastatin, fosphenytoin, frovatriptan, furazolidone, gabapentin, gemfibrozil, glibenclamide, glipizide, glyburide, glimepiride, griseofulvin, halofantrin, ibuprofen, irbesartan, irinotecan, isosorbide dinitrate, isotretinoin, itraconazole, ivermectin, ketoconazole, ketorolac, lamotrigine, lansoprazole, leflunomide, lisinopril, loperamide, loratadine, lovastatin, L-thyroxine, lutein, lycopene, medroxyprogesterone, mifepristone,

mefloquine, megestrol acetate, methadone, methoxsalen, metronidazole, miconazole, midazolam, miglitol, minoxidil, mitoxantrone, montelukast, nabumetone, nalbuphine, naratriptan, nelfinavir, nifedipine, nilsolidipine, nilutanide, nitrofurantoin, nizatidine, omeprazole, oprevelkin, oestradiol, oxaprozin, paclitaxel, paracalcitol, paroxetine, pentazocine, pioglitazone, pizofetin, pravastatin, prednisolone, probucol, progesterone, pseudoephedrine, pyridostigmine, rabeprazole, raloxifene, rofecoxib, repaglinide, rifabutine, rifapentine, rimexolone, ritanovir, rizatriptan, rosiglitazone, saquinavir, sertraline, sibutramine, sildenafil citrate, simvastatin, sirolimus, spironolactone, sumatriptan, tacrine, tacrolimus, tamoxifen, tamsulosin, targretin, tazarotene, telmisartan, teniposide, terbinafine, terazosin, tetrahydrocannabinol, tiagabine, ticlopidine, tirofibrin, tizanidine, topiramate, topotecan, toremifene, tramadol, tretinoin, troglitazone, trovafloxacin, ubidecarenone, valsartan, venlafaxine, verteporfin, vigabatrin, vitamin A, vitamin D, vitamin E, vitamin K, zafirlukast, zileuton, zolmitriptan, zolpidem, zopiclone, pharmaceutically acceptable salts, isomers and derivatives thereof, and mixtures thereof.

17. The system of claim 14, wherein the hydrophilic active ingredient can be a cytokine, a peptidomimetic, a peptide, a protein, a toxoid, a serum, an antibody, a vaccine, a nucleoside, a nucleotide, a portion of genetic material, a nucleic acid, or a mixture thereof

18. The invention of claim 14, wherein the hydrophilic active ingredients are selected from the group consisting acarbose, acyclovir, acetyl cysteine, acetylcholine chloride, alatrofloxacin, alendronate, aglucerase, amantadine hydrochloride, ambenonium; amifostine, amiloride hydrochloride, aminocaproic acid, amphotericin B, antihemophilic factor (human), antihemophilic factor (porcine), antihemophilic factor (recombinant), aprotinin, asparaginase, atenolol, atracurium besylate, atropine, azithromycin, aztreonam, BCG vaccine, bacitracin, becalermine, belladonna, bepridil hydrochloride, bleomycin sulfate, calcitonin human, calcitonin salmon, carboplatin, capecitabine, capreomycin sulfate, cefamandole nafate, cefazolin sodium, cefepime hydrochloride, cefixime, cefonicid sodium, cefoperazone, cefotetan disodium, cefotaxime, cefoxitin sodium, ceftizoxime, ceftriaxone, cefuroxime axetil cephalixin; cephalirin sodium, cholera vaccine, chorionic gonadotropin, cidofovir, cisplatin, cladribine, clidinium bromide, clindamycin and clindamycin derivatives, ciprofloxacin, clodronate, colistimethate sodium, colistin sulfate, corticotropin, cosyntropin, cromolyn sodium, cytarabine, dalteparin sodium, danaparoid, desferrioxamine, denileukin diflitox, desmopressin, diatrizoate meglumine and diatrizoate sodium, dicyclomine, didanosine,

dirithromycin, dopamine hydrochloride, dornase alpha, doxacurium chloride, doxorubicin, etidronate disodium, enalaprilat, enkephalin, enoxaparin, enoxaprin sodium, ephedrine, epinephrine, epoetin alpha, erythromycin, esmolol hydrochloride, factor IX, famciclovir, fludarabine, fluoxetine, foscarnet sodium, ganciclovir, granulocyte colony stimulating factor, granulocyte-macrophage stimulating factor, growth hormones -recombinant human, growth hormone - bovine, gentamycin, glucagon, glycopyrolate, gonadotropin releasing hormone GnRH and synthetic analogs thereof, gonadorelin, grepafloxacin, hemophilus B conjugate vaccine, Hepatitis A virus vaccine inactivated, Hepatitis B virus vaccine inactivated, heparin sodium, indinavir sulfate, influenza virus vaccine, interleukin-2, interleukin-3, insulin-human, insulin lispro, insulin procine, insulin NPH, insulin aspart, insulin glargine, insulin detemir, interferon alpha, interferon beta, ipratropium bromide, ifosfamide, Japanese encephalitis virus vaccine, lamivudine, leucovorin calcium, leuprolide acetate, levofloxacin, lincomycin and lincomycin derivatives, lobucavir, lomefloxacin, loracarbef, mannitol, measles virus vaccine meningococcal vaccine, menotropins, mepenzolate bromide, mesalamine, methenamine, methotrexate, methscopolamine, metformin hydrochloride, metoprolol, mezocillin sodium, mivacurium chloride, mumps viral vaccine, nedocromil sodium, neostigmine bromide, neostigmine methyl sulfate, neurontin, norfloxacin, octreotide acetate, ofloxacin, olpadronate, oxytocin, pamidronate disodium, pancuronium bromide, paroxetine, perfloxacin, pentamidine isethionate, pentostatin, pentoxifylline, periciclovir, pentagastrin, pentholamine mesylate, phenylalanine, physostigmine salicylate, plague vaccine, piperacillin sodium, platelet derived growth factor-human, pneumococcal vaccine polyvalent, poliovirus vaccine inactivated, poliovirus vaccine live (OPV), polymyxin B sulfate, pralidoxime chloride, pramlintide, pregabalin, propafenone, propenthaline bromide, pyridostigmine bromide, rabies vaccine, residronate, ribavarin, rimantadine hydrochloride, rotavirus vaccine, salmeterol xinafoate, sinealide, small pox vaccine, sotalol, somatostatin, sparfloxacin, spectinomycin, stavudine, streptokinase, streptozocin, suxamethonium chloride, tacrine hydrochloride, terbutaline sulfate, thiopeta, ticarcillin, tiludronate, timolol, tissue type plasminogen activator, TNFR:Fc, TNK-tPA, trandolapril, trimetrexate gluconate, trospectinomycin, trovafloxacin, tubocurarine chloride, tumor necrosis factor, typhoid vaccine live, urea, urokinase, vancomycin, valacyclovir, valsartan, varicella virus vaccine live, vasopressin and vasopressin derivatives, vecuronium bromide, vinblastine, vincristine, vinorelbine, vitamin B12, warfarin sodium, yellow fever vaccine, zalcitabine, zanamivir, zolendronate, zidovudine, pharmaceutically

acceptable salts, isomers and derivatives thereof, and mixtures thereof.

19. The invention of claim 14, wherein the composition of the drug included as active ingredient is formulated for immediate release, pulsatile release, controlled release, extended release, delayed release, targeted release, or targeted delayed release.

20. The invention of claim 14, wherein there is therapeutic delivery of antibacterial and antiviral agents in a tissue specific manner at target lesion sites.